Quotient rule

Just as you must always use the product rule when two variable expressions are multiplied, you must use the quotient rule whenever two variable expressions are divided. Given a function

$$h(x) = \frac{f(x)}{g(x)}$$

then its derivative is

$$h'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{\left[g(x)\right]^2}$$

Example

Use quotient rule to find the derivative.

$$h(x) = \frac{x^2}{\ln x}$$

Based on the quotient rule formula, we know that $f(x)$ is the numerator and therefore $f(x) = x^2$ and that $g(x)$ is the denominator and therefore that $g(x) = \ln x$. $f'(x) = 2x$, and $g'(x) = 1/x$. Plugging all of these components into the quotient rule gives

$$h'(x) = \frac{\left(\ln x\right)(2x) - \left(x^2\right)\left(\frac{1}{x}\right)}{\left(\ln x\right)^2}$$

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$$h'(x) = \frac{2x \ln x - x}{(\ln x)^2}$$

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